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TITLE OF THE INVENTION (280 characters max)

ROAMING FOR PREPAID MOBILE TELEPHONE SERVICE

CORRESPONDENCE ADDRESS

Direct all correspondence to:

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ENCLOSED APPLICATION PARTS (check all that apply)

☒ Specification   *Number of Pages*   23

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Respectfully submitted,

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P19LARGE/REV04

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Roaming for Pre-paid

Marketing Requirements Document

Revision History:

Rev.	Date	Author	Description
1.0	1/12/99	Yuval Shachar	Draft (without registration description)
1.1	16/12/99	Yuval Shachar	After internal review

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Roaming for Pre-paid – Marketing Requirements

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1 Introduction

1.1 Background

A seamless Pre-paid solution for mobile users requires both intimate interface to the users balance storage and call control capabilities by the network managing the call. In GSM, Pre-paid subscribers are usually limited to their home network coverage. The reasons are that operators are reluctant to expose their database to other networks and missing infrastructure to manage these calls at the visited network. Hence, most operators will define the pre-paid users in a configuration that will prevent registration at other networks.

1.2 Preface

Roaming for Pre-Paid is provided to mobile subscribers visiting in countries other than their home country. The service allows these pre-paid users to register to a visited PLMN as regular visiting subscribers and get the two most basic services of mobile communication - originating and receiving voice calls. In addition, all other *star*home* services (HSC, MC2, etc.) will be available to RPP users.

As with other services provided by *star*home*, the RPP makes use of the *star*home* IP network in order to bring the call management capability to the visited network. However, the implementation of the service is based also on plain signaling and voice routing or IN.

A three-stage approach is required for seamless implementation of RPP:

Registration is denied from pre-paid subscribers while roaming at a foreign network. This restriction is applied by the HLR (in the home network) which differs between regular and pre-paid registration requests. Requests of pre-paid users coming from other networks are rejected immediately, preventing the roamer from registering to a hosting network.

Therefor, *star*home* is to mediate these registration requests (Location Updates hereafter). Requests arriving from unauthorized visited networks will be rejected as before, while requests arriving from *star*home* network partners will be allowed by both *star*home* and the HLR.

Mobile Originated Calls are fully controlled by the IntelliGate at the visited network. The *star*home* IP network will be used to access the IntelliGate at the home network for call duration calculation using the pre-call balance and roaming tariff tables, call management by the local IntelliGate, and post-call reduction of consumed balance. The IntelliGate queries and updates the pre-paid system of the home network using a serial interface.

Mobile Terminated Calls are managed at the home network only. If necessary, based on the enhanced registration process by *star*home*, all incoming calls to roamers will be routed to the IntelliGate which will manage the call process with identical functionality to MO calls processing.

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1.3   Terms, Acronyms and Abbreviations

|		
CAMEL	Customized Application for Mobile network Enhanced Logic	
CFU	Call Forwarding Unconditional	
CLI	Calling Line Identification	
COS	Class Of Service	
DN	Dialed Number	
GMSC	Gateway MSC	A standard function in a GSM PLMN
H-I/G	Home I/G	An I/G connected to subscriber's HPLMN
HLR	Home Location Registry	A standard function in a GSM PLMN
HPLMN	Home PLMN	
HSC	Home Short Code translation	Another service offered by star*home
I/G	IntelliGate	A star*home gateway
IMSI	International Mobile Subscriber Identity	
IN	Intelligent Network	
INAP	Intelligent Network Application Part	
IP	Internet Protocol	
LAN	Local Area Network	
LU	Location Update	
ME	Mobile Equipment	
MO	Mobile Originated	
MSC	Mobile Switching Center	
MSISDN	Mobile Station International Subscriber Directory Number	
MSRN	Mobile Station Roaming Number	
MT	Mobile Terminated	
ODB	Operator Determined Barring	An administrative function in a GSM HLR
PLMN	Public Land Mobile Network	
RPP	Roaming for Pre-Paid	
SN	Service Node	
SS#7	Signaling System number 7	
V-I/G	Visited I/G	An I/G connected to the VPLMN
Visitor	Relates to a VPLMN: A subscriber of other PLMN (usually of other country) who has registered as a visitor in the PLMN	
VLR	Visited Location Registry	A standard function in a GSM PLMN
VMSC	Visited MSC	An MSC in a VPLMN
VPLMN	Visited PLMN	The PLMN where the visitor is registered

2 Description

2.1 Network Architecture

The figure below depicts the *star*home* network architecture and interfaces at both visited and home networks.
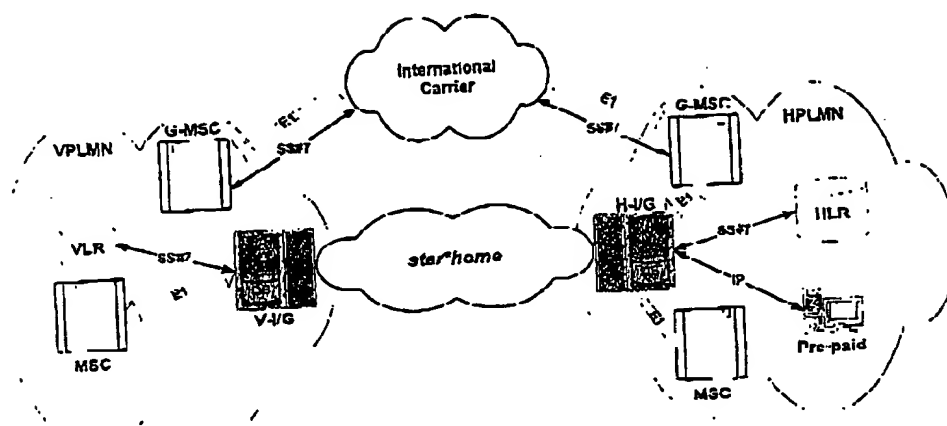
An I/G is integrated to the visited PLMN by means of E1 trunks and signaling interface connected to the GMSC and MSC/VLR. The MSC/VLR is programmed to route pre-paid roaming traffic to the V-I/G by plain routing or, in case that the network is IN or CAMEL Ph1 ready, by triggers installed by *star*home* during the registration process.

An I/G is integrated to the home PLMN by means of E1 trunks and signaling interface connected to the GMSC/MSC and HLR. If the network is not CAMEL Ph1 ready the Location Update messages (SS#7 MAP layer) are routed through the H-I/G (serving as an SCCP relay) to the HLR or being rejected if coming from non star*home networks.

The H-I/G is also interfacing the home network's pre-paid system using the administrative customer care call center system LAN protocol. If the pre-paid solution is IN based an INAP interface can be considered although the same LAN connection will suffice as well.

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2.2 Application Architecture

The figure below depicts the internal architecture in both IntelliGates.
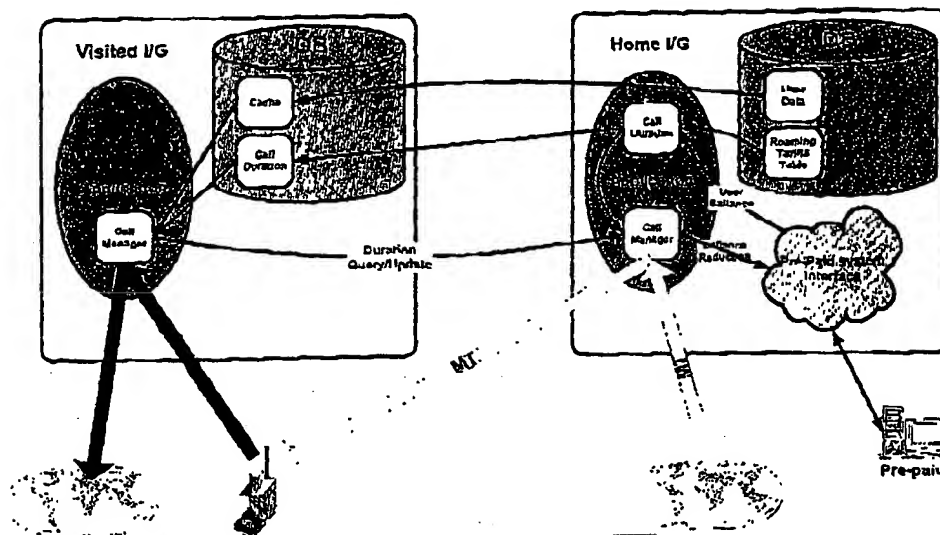
2.3 System Functionality

Detailed call flow description and system functionality are to be found in section 3, Scenarios.

Basic guidelines:

- A pre-paid user will be identified by additional fields in the *star*home* network database. The mandatory fields are PP user indicator, IMSI number (required for SCCP registration and billing), and the MSISDN (for MO call routing). Another field is the pre-paid user roaming password. The password should be used optionally (by COS) for MO call authorization and for "phone less roaming".

- The pre-paid user will be able to seamlessly access all other features offered by *star*home* (short code translation, voice mail retrieval, etc.).

- The user will be able to connect to selected numbers and short codes (customer care for recharging, etc.) at the home network and selected numbers and short codes (emergency, etc.) at the visited networks even if the balance is exhausted.

- The application should be able to play pre, mid, and post call announcements in the user's home language. These announcements may include user balance, low balance warning, incoming CLI, etc.

- The functionality of a conference call will not be supported.

- In case of an incoming call when another call is in place, the second call should be rejected (the user will not pay for voice mail tromboning).

- The application should support "phone-less roaming" for users dialing to a common access number and providing their MSISDN and roaming password to utilize the PP balance to place calls from any accidental phone.

2.4   Pre-paid System Interface

2.4.1   LAN/IP Interface

The H-I/G application should be able to perform two transaction types with the pre-paid system:

- Retrieve user balance

- Decrease user balance by X money units

These transactions should be performed regardless of the platform vendor (Converse, Siemens, Nokia, Ericsson, etc.), basic architecture (SN or IN), and currency.

If the pre-paid platform is capable of managing the roaming tariff tables internally, then the system interface should include a full support for querying the relevant table or tariff and the application should use this input rather than the external tables.

2.4.2   INAP Interface

The application should be designed to support IN based pre-paid through INAP interface. Such support should include (conditioned in the roaming tables stored in the pre-paid system):

- The capability for the I/G to present itself as an SSF and VMSC by SS#7 address

- Support of INAP commands and session between SSF (I/G) and SCP (the pre-paid platform)

2.5   Tariffs Handling

Although tariffing of pre-paid services is rather complicated, it is expected that for RPP the schema will be simpler. The incentives to the home operator are:

- A provisioning nightmare because of the need to maintain a separate table for each roaming partner.

- The high perception of this premium service that will initially eliminate the need for special discount rates.

However, the I/G should be able to support separate tables for each visited network. Each table will support several profiles to be chosen from according to the user profile, time of day, and date (calendar, weekdays, weekends, holidays, etc.). Since it is per network based, the time difference between networks can be embedded seamlessly using the home time as a baseline (unless the visited network covers multiple time zones). The content of these profiles should include at least the following fields:

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- Initial charge unit length (seconds)
- Initial charge unit rate (currency)
- Additional charge unit length (seconds)
- Additional charge unit rate (currency)

The application in the H-I/G will use both charges to calculate allowed call duration and amount of credit consumed de facto.

2.6   Security

Since this application involves with real time charging and money storage and control, it should be secured in a way that would not expose the home pre-paid accounts to additional risk from remote, on top of the local ones. In addition the application should be built to insure the encapsulation of the home network tariffs and policy from the visited networks.

Hence only the following transactions are allowed between the two I/G performing the network application:

- Caching of subscriber identity and profile for real-time decision about the activation of a pre-paid session.

- The user balance will never be cached in the I/G[1]. The retrieved balance will be used for the time conversion and immediately removed from the I/G application. If for seamless usage it is required to start the session faster than the response time of the pre-paid system, it is advised to do so by allocating a grace period until the real balance is obtained rather than caching last call's remaining balance. The algorithm may be improved by additional flag (go/no go only) calculated after the last call from the remaining balance and safety interval chosen by the HPLMN.

- Both IntelliGates can only query/update each other by time units, i.e. call duration will always be calculated at the home network and balance updates will always be stated in seconds at the V-I/G and translated to local currency only in the H-I/G.

2.7   Fraud Prevention

Basic fraud prevention capabilities should be incorporated into the basic RPP application:

A user will not be able to maintain more than a single phone call at a time.

A user will not be able to place/receive consecutive phone calls to/from distant locations unless a reasonable time has elapsed. This functionality will be setup in the H-I/G according to the HPLMN preferences.

A user will not be able to consume more than M amounts of money in less than T seconds (system parameters) as well as an optional (COS) limit on single call duration

In addition, a commercial fraud prevention utility (profiler) will be added to the system in order to prevent illegal exploiting of the pre paid database access. The profiler will use activity records

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[1] This methodology will also prevent negative credit caused by off line charging of user balance (such as monthly fees, etc.).

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provided by the RPP application and billing CDRs as well as global information available from the users' location database to efficiently protect the system from malicious usage.

In case of any suspicious of fraud/malicious activity in the system, an appropriate warning should he issued at the home network. All incoming calls should be rejected and outgoing calls will be routed to tho customer care regardless of the DN.

2.8   OMAP

2.8.1   Provisioning

As emphasized in section 2.6, all user profile RPP fields, tariff tables, and home network special numbers will he stored and managed in the home IntelliGate. These tables will not he replicated at any situation to other networks. Provisioning of the profiles and management of home network tables will be part of the H-I/G OMAP.

The emergency and customer service numbers (or short codes) of the visited network will be stored in the V-I/G and managed as part of its OMAP.

2.8.2   Alarms

General alarms (voice ports, database, network, etc.) will be part off the *star*home* network and gateways OMAP. In addition the additional alarms and functionality are required specifically for RPP application:

- Pre-paid system Interface is down. In such an event a critical alarm should be generated to the *star*home* control room and home network. All MO callers defined in the disconnected system will be prompted with a special announcement and/or be routed to the customer care in the home network. The only exception is the calls directed to the emergency numbers at the visited network. MT calls will be rejected and the callers will be notified that the service is not available.

- Fraud alert as described in section 2.7 will generate a report at the *star*home* control room. The home network will be advised to disable roaming for this user in the HLR until further Investigation. All MO calls will be routed to the customer care in the home network. MT calls will be rejected and the callers will be notified that the service is not available.

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3 Scenarios

3.1 Registration

As an initial assumption, the pre-paid subscribers shall be allowed for roaming service in the HLR. There are two alternatives to perform the special registration required for implemeting RPP in GSM networks.

3.1.1 Registration by SCCP Relaying and MAP Screening

The figure below depicts the registration process at both visited and home networks.
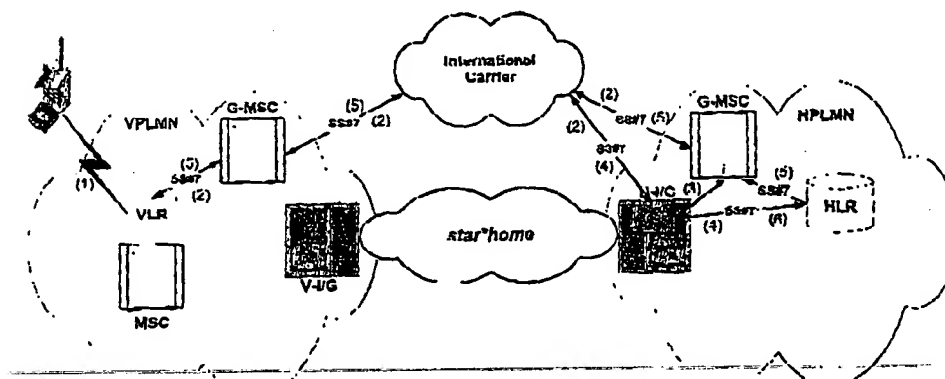
1. The roamer turns on the ME, which tries to register with the nearby VLR.

2. The VLR sends the LU request to the home network.

3. A high performance SS#7 message-capturing device is relaying the signaling links on which roaming Location Update messages run, or these specific messages are routed to the H-I/G using an STP/SCCP relay. The point(s) of capturing depends on the specific HPLMN network configuration. Usually this point would be the GMSC or any other transit switch.

4. The I/G rejects LU requests of pre-paid users coming from VPLMNs not connected to the *star*home* network. All other LU requests are passed on seamlessly to the HLR.

5. Responses, either rejected or accepted requests, along with user profile data, are sent back to the visited network (standard GSM procedure).

6. The H-I/G issues a Supplementary Service, Call Forwarding Unconditional command to the HLR to route all incoming (MT) calls to the H I/G.[2]

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[2] This command is activated using the LAN interface of the HLR in order to prevent user overrides.

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3.1.2   Registration by CAMEL Ph. 1

The VPLMNs should be divided twice, firstly to those who support CAMEL, and among them, those who are members of the star*home network RPP solution.

As to treat networks without CAMEL capability, the HPLMN shall act in accordance to the GTS 02.78 sub-clause 9.1, which obligates the HPLMN to handle roaming to non CAMEL-supporting networks. The HPLMN shall have the ability to determine on a per subscriber basis whether to allow location update in those networks.

Among the group of CAMEL-supporting networks, the user will be registered. For networks which are not star*home members, every MO call will be barred by the home SCP which will handle or interface the star*home members list. MT calls are in any case routed to and treated in the HPLMN, so there is no problem in relation to the registration process.
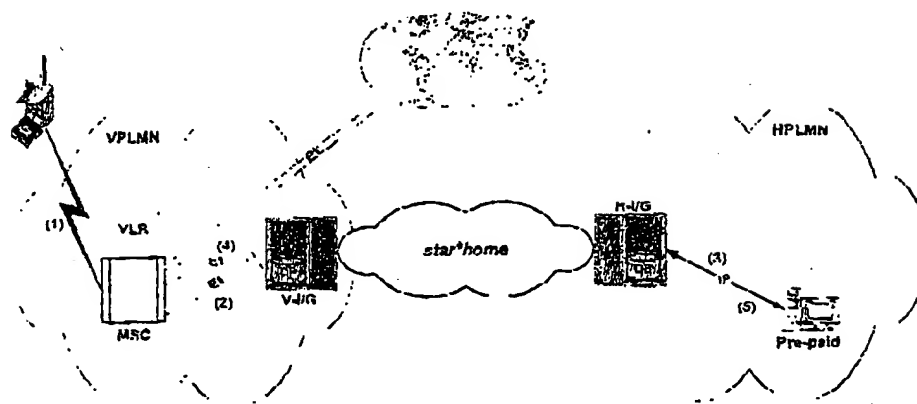
For a detailed description please refer to "Roaming for Pre-Paid Technical Analysis for GSM", Revision 3.0 (Pure CAMEL Ph.1 solution for VPLMN & HPLMN) by Gitai Naveh.
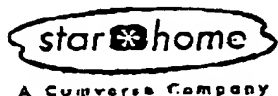
3.2   Mobile Originated Calls

The figure below depicts the call flow in the MO calls scenario.

1. The visitor dials the requested number as if he was a regular subscriber.

2. The MSC routes the call to the V-I/G. This step implies that the routing tables in the MSC will be modified by the VPLMN operator to allow the routing to the V-I/G of calls being placed by roamers of star*home network operators.

    Alternatively, the MSC will route all barred calls to the V-I/G. In this case, the H-I/G will activate during registration, the Operator Determined Barring (ODB) of PP users roaming at such network.

    If the routed call was not of a pre-paid user, and it is not intended for one of the other services offered by star*home, or if using ODB and the caller is a barred local user, the V-I/G releases the call with redirection address. This action assumes that the MSC supports "seamless call switching"[1].

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[1] The implementation of "seamless call switching" may vary between switch vendors, and requires a cooperation between star*home and the switch vendor. Possible implementations to consider are:

  • ISUP RELEASE message with REDIRECTION address

  • FACILITY REQUEST for EXPLICIT CALL TRANSFER supplementary service invocation.

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If the network is CAMEL Ph.1 ready, *star*home* will install CAMEL triggers in the VLR during registration process to route calls per user basis (refer to section 3.1.2).
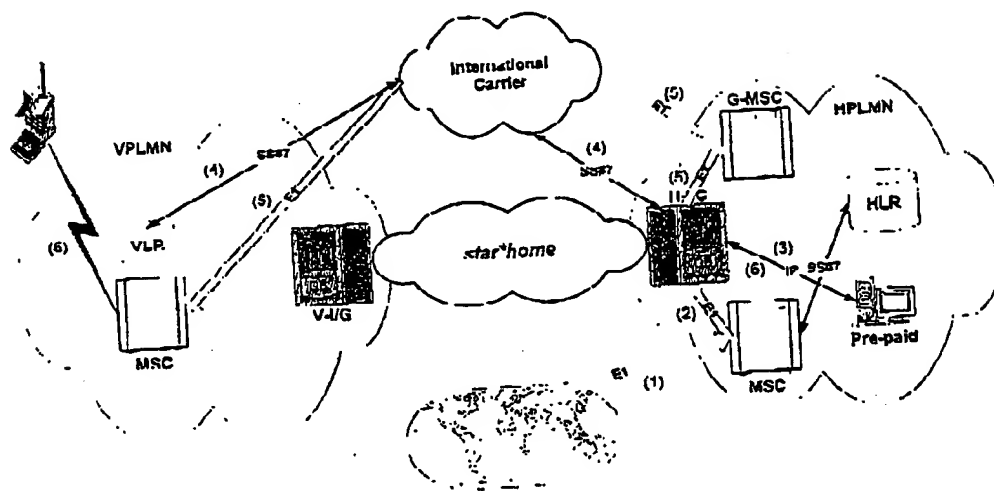
3   The V-I/G queries the H-I/G through the *star*home* IP network for the allowed call duration. The H-I/G retrieves the remaining balance from the pre-paid system using the customer care serial interface. It uses the balance and its internal tariff table to calculate the allowed call duration from the location of the roamer to the required destination (DN). It then returns the maximum call duration for the next call to the V-I/G.

4.   A second leg is generated by the V-I/G placing an out call on behalf of the subscriber, and switching it to the 1st leg, using its own switching capability (the second leg can be generated VoIP through the *star*home* network if so agreed by both networks). This step is required for the V-I/G to keep managing the call and terminate it when the user's balance is exhausted. In such a case, the V-I/G will disconnect the second leg and optionally, route the caller to the customer care at the home network for re-charging.

If the initial call duration is shorter than the allowed trash-hold, the second leg will not be generated the first place and instead, the V-I/G will play an error message suggesting the user to connect to the customer care for re-charging of its balance.

5.   The V-I/G updates the H-I/G with the actual call duration. The H-I/G calculates the money value of the call, and sends a decrease balance command to the pre-paid system with the appropriate amount.

6.   The V-I/G generates a CDR for billing in the visited network, or modifies the original CDR issued by the switch for the first leg (refer to section 4 for detailed description).

3.3　Mobile Terminated Calls

The figure below depicts the call flow in the MT calls scenario.

1. An incoming (MT) call is arriving at the HPLMN GMSC or one of the MSCs.
2. The MSC routes the call to the II-I/G. This functionality is achieved by the CFU activated in the HLR during the registration process (as described in section 3.1). If the network supports CAMEL and deploy IN based PP solution, the call may be routed directly to the pre-paid IP and managed by regular INAP/CAP protocol.
3. The I/G retrieves the remaining balance from the pre-paid system using the customer care LAN interface. It uses the balance and its internal tariff table to calculate the allowed call duration from the home network to the roamer.
4. The I/G keeps track of the roamer's location in its database, and requests routing information from the visited network[4]. The VLR returns the required MSRN to the I/G.
5. A second leg is generated by the I/G placing an out call to the user using the MSRN, and switching it to the 1st leg using its own switching capability. This step is required for the I/G to keep managing the call and terminate it when the user's balance is exhausted.

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[4] Refer to Appendix TBD

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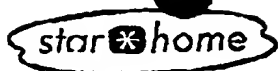
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If the initial call duration is shorter than the minimum allowed trash-hold, the second leg will not be generated the first place and the caller will be routed to the voice mail, or if not applicable, will hear an error message and be disconnected.

Prior to connecting the two legs, the I/G should ask the roamer whether she would like to receive the incoming call from this CLI. If the roamer rejects the call, the caller will be routed to the voice mail, or if not applicable, will hear an error message and be disconnected.

6. The I/G calculates the money value of the call, and sends a decrease balance command to the pre-paid system with the appropriate amount.

7. The I/G issues a CDR for billing in the home network.

4 Billing considerations[5]

Billing at the visited network should not be different than the regular *star*home* solution.

4.1   Mobile Originated Calls

In this case the VMSC has all the information for billing since it has the real CLI, DN, and call duration. The second leg will be ignored.

An appropriate amount will be automatically reduced from the subscriber's balance in the home network to reflect both payments to the hosting network and the surcharge to the home operator. An appropriate CDR will be issued by the H-I/G for the customer care records only, and (if necessary) for identification of the pre-paid CDR coming from the visited network for inter-network clearing.

4.2   Mobile Terminated Calls

In this case, since leg 1 of the call is being paid for by the calling party, the H-I/G will generate only one CDR to reflect the cost of the international leg of the call. This leg is billed of course to the called party.

An appropriate amount will be automatically reduced from the subscriber's balance in the home network after each call.

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[5] *star*home* will be more than happy to discuss these issues with the operator in order to jointly find the best way to handle the billing issues.

Roaming for PrePaid (GSM)

CAMEL Ph.1 based service- Technical Overview

Date: 11.01.00

Author: Gitai Naveh

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Acronyms & Abbreviations

ATI- MAP_Any_Time_Interrogation

CAMEL- Customized Applications for Mobile network Enhanced Logic

CAP- CAMEL Application Part

DP- Detection Point

E.164- ISDN number

GMSC- Gateway MSC

GTS- GSM Technical Specifications

HLR- Home Location Register

HPLMN- Home Public Land Mobile Network

IC- Incoming

I/O- IntelliGate. V=Visited, H=Home

IMSI- International Mobile Subscriber Identity

MAP- Mobile Application Part

MO- Mobile Originated

MSC- Mobile Switching Center

MSRN- Mobile Station Roaming Number

MT- Mobile Terminated

O-BCSM- Origination- Basic Call State Machine

OR- Optimal Routing

PP- PrePaid

RPP- Roaming for PrePaid

SCCP- Signaling Connection Control Part

SCE- Service Creation Environment

SCP- Service Control Point

SRI- MAP_Send_Routing_Information

SRF- Specialized Resource Function

SS7- Signaling System #7

SSRP- SCCP Signaling Relay Point

STP- Signaling Transfer Point

T-BCSM- Termination-Basic Call State Machine

T-CSI- Termination-CAMEL Subscription Information

TDP- Trigger Detection Point

t/o- Time-Out

VLR- Visitor Location Register

VMSC- Visited MSC

VPLMN- Visited Public Land Mobile Network

17

Foreword

The service offered is to enable subscribers that use PP handset to use them outside their home boundary. This document presents a solution for a RPP service, based on CAMEL Ph.1 existence in both HPLMN & VPLMN.

The issues that involved in the service are:

1. Registration- how to enable PP roamers to register when abroad. Currently it's not possible (otherwise the roamers won't be PP ones). Concurrently the registration should be blocked for those operators who are not members of the star*home network.

2. Origination/routing- the PP calls shall be routed to the smr*home's I/G in order to be authorized and tracked in real-time. The reason for this routing over transmission is that the current CAP Ph.1 protocol is insufficient for pure-signaling based service. The method proposed here relies on SRF based architecture.

3. Termination- while the PP subscriber roams, he is charged of the part of the IC call because of the international Leg (Unless OR when the VPLMN and the IPLMN are the same one. In fact, the OR is not implemented in any operator for to date and apparently won't be at least for several years). Thus, his balance should be verified and the call should be tracked. The reason for the international Leg even when CAMEL Ph.1 is implemented is that the current CAP Ph 1 protocol is insufficient for pure-signaling based service. The method proposed here relies on SRF based architecture.

Because of the exact implementation depends on each operator's facilities & requests, the operators- and the solution's architectures as well- are divided into 3 categories:

1. Operators that have a CAMEL SCP and are willing to utilize it in favor of the proposed RPP service.

2. Operators that have no SCP at all.

3. Operators that have a CAMEL SCP, but don't have an interest/resources to utilize it in favor of the proposed RPP service.

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Solution- Architectures

1. Operators that have a CAMEL SCP and are willing to utilize it in favor of the proposed RPP service:

Registration

As an initial assumption, the PP subscribers shall be allowed for a basic roaming service.

The PP subscribers must be provisioned with both O/T-BCSM TDPs in their HLR profile (gsmSCF address = home SCP). That means that every MO & MT call will be triggered, and a CAP query will be sent to the SCP for further instructions.

The VPLMNs can be divided twice into 2 groups: those who have CAMEL at all, and among those with CAMEL- those who are members of star*home's network.

As to treat networks without CAMEL capability, the HPLMN shall act in accordance to the GTS 02.78 subclause 9.1, which obligates the HPLMN to handle roaming to non-CAMEL-supporting networks. The HPLMN's HLR shall have the ability to determine on a per subscriber basis whether to allow location update in those networks.

Among the group of CAMEL-supporting networks, the subscriber will be registered. For networks which are not star*home members, every MO & MT call will be barred by the SCP which will handle the star*home members list. Hence, a simple appropriate service logic should be created by the operator's SCE.

Origination (utilizing home CAMEL SCP)

An O-BCSM TDP (Ph.1- only DP2) shall be included in the PP subscribers' profiles (HLR). While roaming, for every call originated by the subscriber a CAP transaction will be established against the SCP in the HPLMN. The SCP will maintain a simple list of coupling a certain country with the appropriate local I/G-V's port number. Service logic shall be created by the operator's SCE that will reply to the VMSC with an instruction to connect the call to the local I/G-V. While the call is routed to and answered at the I/G-V, it's querying the PP platform at home for an authorization & t/o and continuing by switching the call to the desired destination. For the duration of the call handling by the I/G-V, it can apply future enhancements to the service like announcements/tones in every stage of the call, advanced recharging capabilities and others.

Termination (utilizing home CAMEL SCP)

A T-BCSM TDP (Ph.1- only DP12) shall be given to the PP subscribers. While the call is being terminated at the GMSC of the HPLMN (no OR implemented), the GMSC is querying the HLR with SRI and getting the T-BCSM TDP containing the SCP address. The VLR E.164 is also included in the SRI result and is transferred to the SCP. (If the VLR E.164 is not included in the first SRI result, either the Location Information Interrogation Indicator in the subscriber's HLR profile shall be turned-on in order to provide the location information within the first SRI result or the SCP will use the ATI message in order to obtain the location information from the HLR).

As the SCP discovered that the subscriber is roaming- and within a star*home member net- it will return to the GMSC with connection instructions to the I/G-H. From that point, the I/G-H finds the subscriber by invoking a SRI invoke (T-CSI suppressed) to the HLR and receiving a MSRN. Using the received MSRN, the call is routed to the subscriber and being handled and monitored by the I/G-H. Whilst the call is handled by the I/G-H, it can apply future enhancements to the service like announcements/tones in every stage of the call, advanced recharging capabilities and others.

1. Operators which have no CAMEL SCP:

Registration

As an initial assumption, the PP subscribers shall be allowed for a basic roaming service.

The PP subscribers must be provisioned with both O/T-BCSM TDPs in their HLR profile (gsmSCF address = I/G-H). That means that every MO & MT call will be triggered, and a CAP query will be sent to the I/G-H for further instructions.

The VPLMNs can be divided twice into 2 groups: those who have CAMEL at all, and among those with CAMEL- those who are members of star*home's network.

As to treat networks without CAMEL capability, the HPLMN shall act in accordance to the GTS 02.78 subclause 9.1, which obligates the HPLMN to handle roaming to non-CAMEL-supporting networks. The HPLMN's HLR shall have the ability to determine on a per subscriber basis whether to allow location update in those networks.

Among the group of CAMEL-supporting networks, the subscriber will be registered. For networks which are not star*home members, every MO & MT call will be barred by the I/G-H.

Origination (no home CAMEL SCP)

An O-BCSM TDP (Ph.1- only DP2) shall be included in the PP subscribers' profiles (HLR). While roaming, for every call originated by the subscriber a CAP signaling transaction will be established against the I/G-H in the HPLMN. The I/G-H will maintain a simple list of coupling a certain country with the appropriate local I/G-V's port number and reply to the VMSC with an instruction to connect the call to the local I/G-V. While the call is routed to and answered at the I/G-V, it's querying the PP platform at home for an authorization & t/o and continuing by switching the call to the desired destination. For the duration of the call handling by the I/G-V, it can apply future enhancements to the service like announcements/tones in every stage of the call, advanced recharging capabilities and others.

Termination (no home CAMEL SCP)

A T-BCSM TDP (Ph.1- only DP12) shall be given to the PP subscribers. While the call is being terminated at the GMSC of the HPLMN (no OR implemented), the GMSC is querying the HLR with SRI and getting the T-BCSM TDP containing the I/G-H address. The VLR E.164 is also included in the SRI result and is transferred within the CAP transaction to the I/G-H. (If the VLR E.164 is not

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included in the first SRI result, either the Location Information Interrogation Indicator in the subscriber's HLR profile shall be turned-on in order to provide the location information within the first SRI result or the I/G-H will use the ATI message in order to obtain the location information from the HLR).

As the I/G-H discovered that the subscriber is roaming- and within a star*home member net- it will return to the GMSC with connection instructions to a I/G-H's port. From that point, the I/G-H finds the subscriber by invoking a SRI invoke (T-CSI suppressed) to the HLR and receiving a MSRN. Using the received MSRN, the call is routed to the subscriber and being handled and monitored by the I/G-H. Whilst the call is handled by the I/G-H, it can apply future enhancements to the service like announcements/tones in every stage of the call, advanced recharging capabilities and others.

1. Operators which have a CAMEL SCP and are not able/consenting to utilize it in favor of the proposed RPP service:

Registration

Because of the home SCP won't filter these networks which are not star*home members, the I/G-H shall be integrated with a SSRP platform. Some of the networking configuration of the home network should be changed, so that all MAP messages based on IMSI for SCCP destination address will be routed to the star*home's SSRP instead of to the real HLR/s (operator option: reservation of a special IMSI range for PrePaid subscribers so that MAP signaling only related to the PP subscribers will be routed to the SSRP). The required changes are in the GMSCs/gateway STPs only.

The SSRP will verify that the originating VMSC belongs to a star*home member operator: otherwise it will return a rejection and the registration at that VMSC will be blocked.

In case the SSRP has confirmed the registration at that VMSC, it's tandeming the MAP signaling to the real HLR while modifying the SCCP origination address to its own. From this point all the messages relating to this dialogue are being relayed through the SSRP while the VLR, MSC and HLR addresses in the MAP layer are unchanged.

An additional modification is done by the SSRP to the O-BCSM TDP information downloaded to the VMSC: the gsmSCF address is changed to the I/G-H address. If no O-BCSM information was provisioned to the subscriber, the SSRP will apply it by itself in this stage of the registration process.

Detecting of the roamer getting back to his home network can be done, at this early stage of the service design either by the first call origination/termination or by passive monitoring of the intra-network location updating messages/inter-network location cancellation messages.

Origination (home CAMEL SCP without utilizing it)

An O-BCSM TDP (Ph.1- only DP2) shall be included in the PP subscribers' profiles (HLR) or be applied by the SSRP as part of the registration process. While roaming, for every call originated by the subscriber a CAP signaling transaction will be established against the I/G-H in the HPLMN. The I/G-H will maintain a simple list of coupling a certain country with the appropriate local I/G-V's port number and reply to the VMSC with an instruction to connect the call to the local I/G-V. While the call is

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routed to and answered at the I/G-V, it's querying the PP platform at home for an authorization & t/n and continuing by switching the call to the desired destination. For the duration of the call handling by the I/G V, it can apply future enhancements to the service like announcements/tones in every stage of the call, advanced recharging capabilities and others.

Termination (home CAMEL SCP without utilizing it)

A T-BCSM TDP (Ph.1- only DP12) shall be given to the PP subscribers including the gsmSCF address = I/G-H. While the call is being terminated at the GMSC of the HPLMN (no OR implemented), the GMSC is querying the HLR with SRI and getting the T BCSM TDP containing the I/G-H address. The VLR E.164 is also included in the SRI result and is transferred within the CAP transaction to the I/G-H. (If the VLR E.164 is not included in the first SRI result, either the Location Information Interrogation Indicator in the subscriber's HLR profile shall be turned-on in order to provide the location information within the first SRI result or the I/G-H will use the ATI message in order to obtain the location information from the HLR).

As the I/G-H discovered that the subscriber is roaming and within a star*home member net- it will return to the GMSC with connection instructions to an I/G-H's port. From that point, the I/G-H is finding the subscriber by invoking a SRI invoke (T-CSI suppressed) to the HLR and receiving a MSRN. Using the received MSRN, the call is routed to the subscriber and being handled and monitored by the I/G-H. Whilst the call is handled by the I/G-H, it can apply future enhancements to the service like announcements/tones in every stage of the call, advanced recharging capabilities and others.

Note: if the T BCSM TDP is not provisioned by the operator from any reason, this element will be applied by the SSRP using the Customer Care/management or any other non-SS7 interface to the HLR as the subscriber has been registered abroad.

As the SSRP / I/G-H detects that the subscriber is no longer roaming (VLR E.164 for termination or origination), it'll revoke the T-BCSM from the subscriber's HLR profile.

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CLAIMS

We claim:

1. A method substantially as described hereinabove.

2. A method substantially as illustrated in any of the drawings.

3. Apparatus substantially as described hereinabove.

4. Apparatus substantially as illustrated in any of the drawings

5. A system substantially as described hereinabove.

6. A system substantially as illustrated in any of the drawings.

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